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The phoric response in the nine cardinal fields of gaze

Edwin M. Ward
Pacific University

Keith Arnold
Pacific University

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Abstract

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Degree Type

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Optometry

THE PHORIC RESPONSE IN THE NINE CARDINAL FIELDS OF GAZE

A Thesis
Presented to
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Doctor of Optometry

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by
Edwin M. Ward
and
Keith Arnold
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PROBLEM:

To determine if there is any change in the phoric response in the nine cardinal fields of gaze.

EQUIPMENT:

1. Nine field board, 24" x 30", with illuminated slits, 1/2" x 1 3/8", of opaque glass with fixation letters, 3/32" x 3/16", on each. This is shown on drawing #1.

2. Adjustable chin rest.

3. Adjustable table for nine field board.

4. One 10 diopter prism, 50mm round.

5. One 15 diopter rotary prism, 50mm round.

6. Phorometer stand with head modified to hold prisms.

Drawing #2 shows the angular separation of positions from #1 position in degrees at a working distance of 30 inches.

PROCEDURE:

Ten subjects were taken from the graduating class, ranging in age from 23 to 38 years with an average age of 29.4 years.

Each subject was seated before the board with chin on chin rest, adjusted to a height so that the #1 position on the board was on a horizontal line perpendicular to the face plane with the primary position of gaze centered on the fixation letter.

The subject was instructed to fixate the letter on the upper illuminated slit when dissociated.

A series of phoria readings were taken on each subject twice per day for ten days. A series consists of the following;

One reading from extreme base in position on the rotary prism.

One reading from extreme base out position on the rotary prism.

These were taken on each of the nine positions with an additional reading taken at the #1 position which was labled on the data as #1A.

The number of each position is shown on drawing #1 and the series of readings were taken in this sequence.

RESULTS:

The raw data of the ten subjects is on file in the Visual Training Laboratory at Pacific University.

Table #1

Averages of the findings in each of the ten positions for the ten subjects.

Table #2

Sigma of each of the ten positions for the ten subjects.

Table #3

Average sigma of each of the ten subjects and the average sigma for the group.

Table #4

Mean of the group averages of each position.

Graph #1

Shows the average difference from the average of position #1 for the group.

Graphs #2 to #11 inclusive

Show the difference from position #1 of the other 9 positions for each of the ten subject. Graph #2 is of the subject whose average sigma is nearest to the group average sigma.

Graph #1

Shows positions #2, #8, and #1A to be higher in exophoria than position #1.

Shows positions #3, #4, #5, #6, #7, and #9, to be less exophoric than #1 position.

Graph #2

Phoria reading in the #2 position was the same as phoria reading in #1 position showing no change.

Graph #6

Phoria reading in #2 position shows less exophoria than #1 position.

Graphs #3, #4, #5, #7, #8, #9, and #11

Shows the phoria reading in #2 position is higher than the phoria reading in #1 position. This is also indicated by the group average graph #1.

Graph #4

Shows phoria reading on #3 position to be the same as the #1 position.

Graphs #2, #3, #5, #6, #7, #8, #9, and #11

Shows the phoria reading on #3 position to be less ex ophoric than the phoria reading on #1 position which is also indicated by group graph #1.

Graphs #2 to #11 inclusive

Shows phoria reading on #4 position to be less exophoria than phoria reading on #1 position which is also shown on the group graph #1.

Graphs #3, #5, and #6

Show a phoria reading on #5 position to be more exophoria than the phoria reading on position #1.

Graphs #2, #4, #7, #9, #10, and #11

Show a phoria reading of less exophoria on position #5 than phoria reading on position #1. This is also shown on group graph #1.

Graph #6

Shows a phoria reading on #6 position to be more exophoric than position #1.

Graph #8

Shows the phoria reading on #6 position equal to the reading on #1 position.

Graphs #2, #3, #4, #6, #9, #10, and #11

Show less exophoria on #6 position than found on #1 position.

This is also shown on group graph #1.

Graph #6

Shows position #7 to be more exophoric than position #1.

Graphs #2, #3, #4, #5, #7, #8, #9, #10, and #11

Show less exophoria in position #7 than found in position #1.

This is also shown on group graph #1.

Graphs #2 to #11 inclusive

Show the phoria reading for #8 position to be more exophoric than the phoria reading for the #1 position. This is also shown on the group graph #1.

Graphs #2 to #11 inclusive

Show the #9 phoria reading to be less exophoric than the phoria reading on the #1 position. This is also shown on the group graph #1.

Graph #9

Shows the phoria reading on position #1A to be less exophoric than the phoria reading on the #1 position.

Graph #3

Shows phoria reading on position #1A to be equal to the phoria reading on #1 position.

Graphs #2, #4, #5, #6, #7, #9, and #11

Show the phoria reading on position #1 A to be more exophoric than the reading found on the #1 position. This is also shown on the group graph #1.

CONCLUSIONS:

From the limited data collected on this experiment, it can be assumed that there is a definite difference in the phoria pattern in the different positions of gaze with a marked increase in the exophoria in the superior central position over all the other positions on the nine field board.

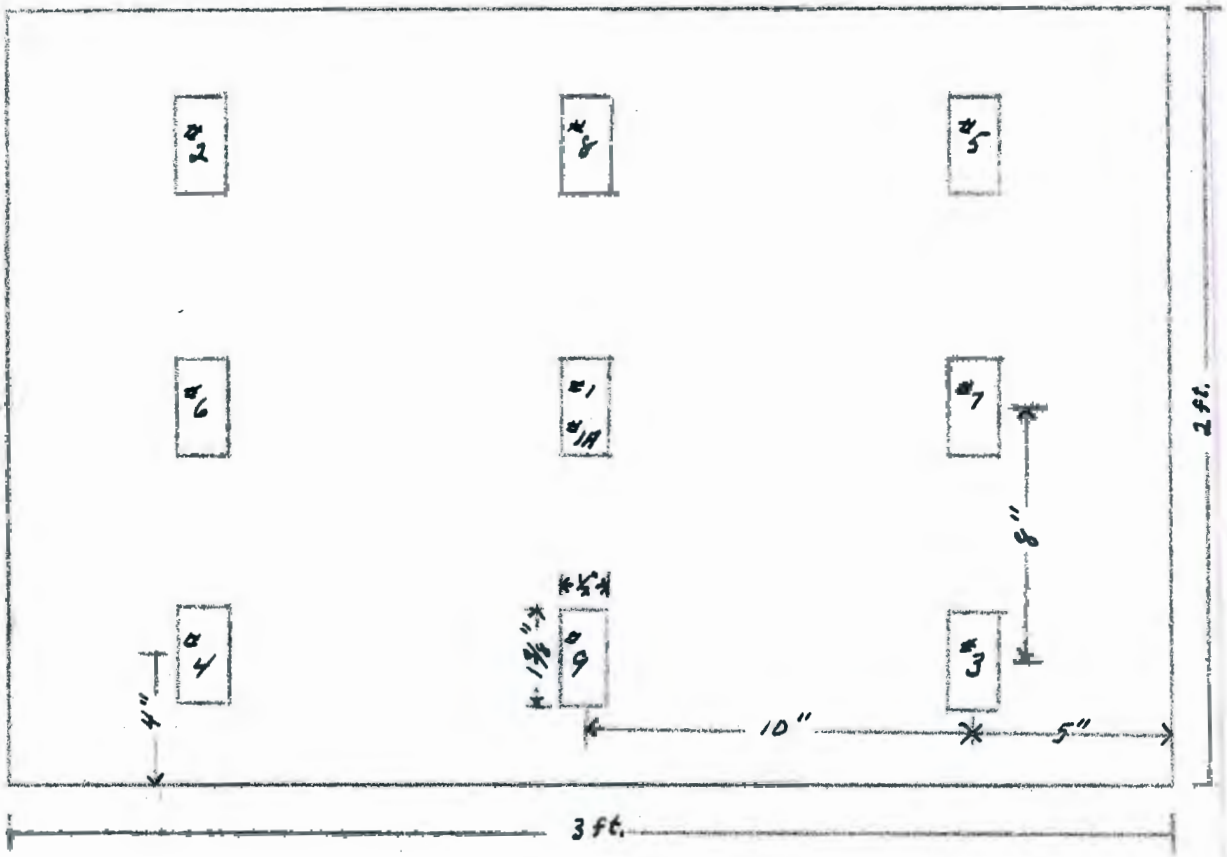
The three lower positions, (from left to right), #4, #9, and #3 are in less exophoria than the other positions.

PROBLEMS TO CONSIDER IN FUTURE TESTING OF PATIENTS WITH THIS EQUIPMENT.

1. Is the phoria relationship of patients with known binocular problems the same as found on this experiment?
2. Is the lower phoria reading found on positions #3 and #4 due to the thickness of the prisms used or is this the functional qualities of the human organism?
3. Will the use of a Maddox rod eliminate the above or magnify it?
4. Would the same pattern of findings be found if the testing were done in a room of total darkness so as to eliminate the edge of the board being visable?

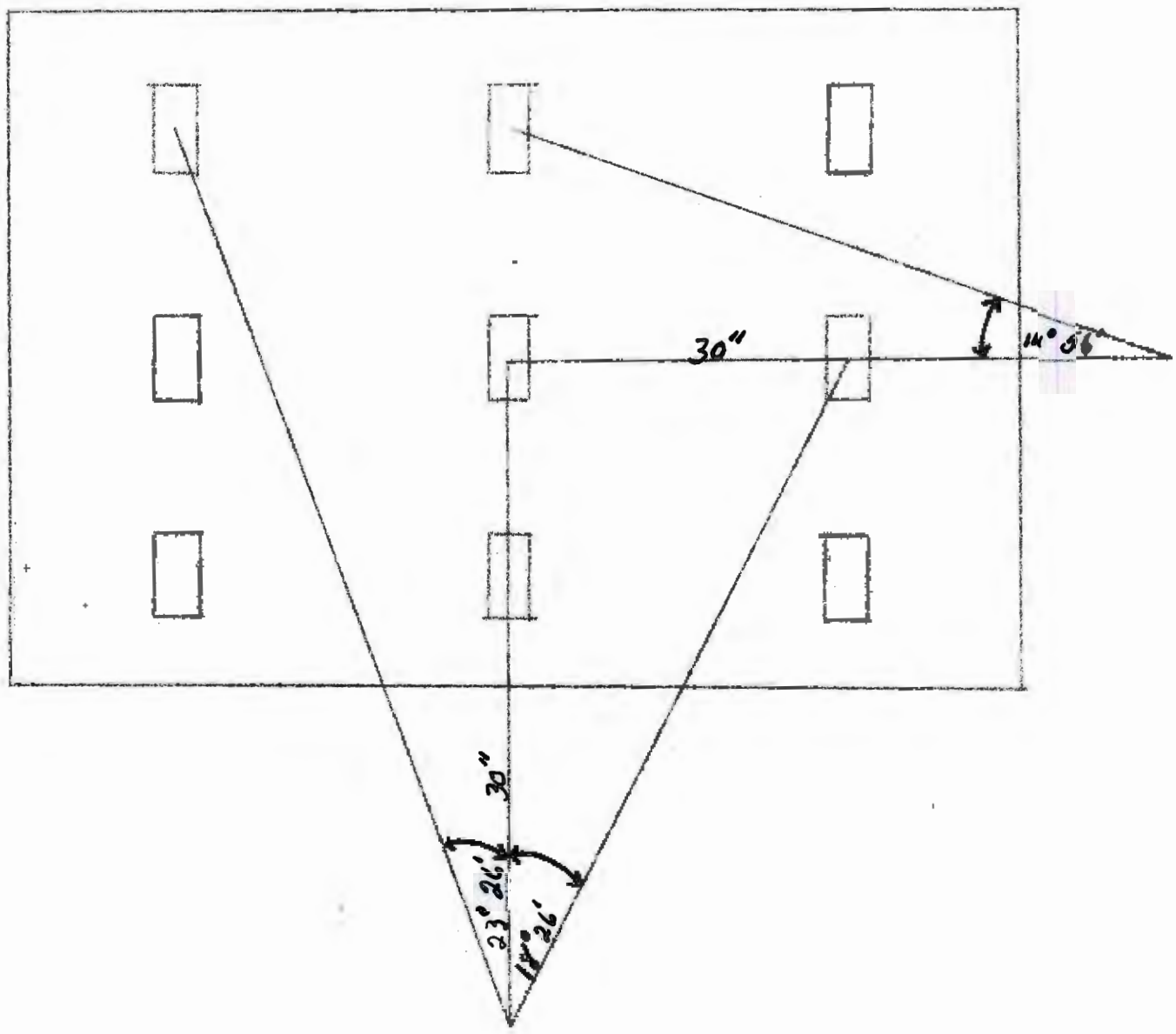
5. Does eye dominancy have any effect on a group average, comparing two groups with either all exophoric or esophoric patterns?

Drawing #1 -Not to scale-



Board Dimensions and Fixation Slits Numbered in Their Order of Sequence.

Drawing #2 -not to scale-



Angular Separation of positions from position #1
in degrees at Working distance of 30 inches

Table #1

Average Phoria in Each Position

	Position									
Subj.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1	4.25 XO	6.25 XO	5.25 XO	3.50 XO	5.50 XO	5.50 XO	6.00 XO	7.50 X	5.25 XO	6.75 XO
2	5.75 XO	6.25 XO	4.50 XO	3.50 XO	6.00 XO	5.25 XO	5.50 XO	6.25 XO	4.50 XO	5.75 XO
3	2.50 XO	3.00 XO	2.50 XO	.50 SO	1.75 XO	1.25 XO	2.00 XO	3.25 XO	1.25 XO	2.25 XO
4	6.25 XO	6.50 XO	4.25 XO	3.25 XO	5.00 XO	6.00 XO	5.75 XO	8.50 XO	4.75 XO	6.75 XO
5	3.00 XO	4.75 XO	2.75 XO	2.00 XO	3.50 XO	3.75 XO	3.50 XO	5.25 XO	2.50 XO	3.50 XO
6	9.00 XO	9.50 XO	7.50 XO	5.50 XO	8.00 XO	8.00 XO	8.50 XO	10.25 XO	8.25 XO	9.50 XO
7	4.25 XO	5.25 XO	3.75 XO	2.75 XO	4.00 XO	4.25 XO	4.00 XO	5.25 XO	4.00 XO	4.50 XO
8	8.00 XO	9.00 XO	5.50 XO	5.00 XO	7.25 XO	7.25 XO	6.50 XO	9.50 XO	6.25 XO	7.75 XO
9	2.00 XO	2.50 XO	.25 XO	.50 SO	.25 XO	.75 XO	.25 XO	2.50 XO	1.00 XO	1.25 XO
10	6.25 XO	2.75 XO	4.50 XO	3.25 XO	6.00 XO	5.25 XO	5.00 XO	9.25 XO	4.75 XO	6.75 XO

Table #2

Sigma For Each Position

	Position									
Subj.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1	.74	1.26	.69	.64	.81	.84	.91	.46	1.00	1.01
2	.53	.87	.71	.37	.40	.52	.49	.33	.71	.76
3	1.32	1.56	1.47	1.27	.92	1.87	.26	1.33	1.34	2.18
4	.88	.66	.71	.52	.56	.19	.31	.57	.73	.59
5	.82	1.32	.16	.87	.64	.52	.55	.50	.34	.53
6	1.39	.93	1.07	1.20	1.14	.83	1.16	.90	1.19	1.03
7	1.12	1.34	1.09	.58	1.30	1.07	1.15	1.20	1.15	1.36
8	.20	.74	.52	.87	.98	.84	.91	1.04	.23	.80
9	1.42	1.08	1.20	1.07	1.49	1.43	1.19	1.64	.27	1.38
10	1.00	1.22	.25	.88	.64	.68	.85	.25	.87	.82

Table #3

Average Sigma For Each Subject

	Subject									
	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
Ave Sigma	.84	.52	1.35	.57	.52	1.04	1.13	.72	1.21	.68

Average Sigma For Group = .86

Table #4

Mean Average for Group in Each position

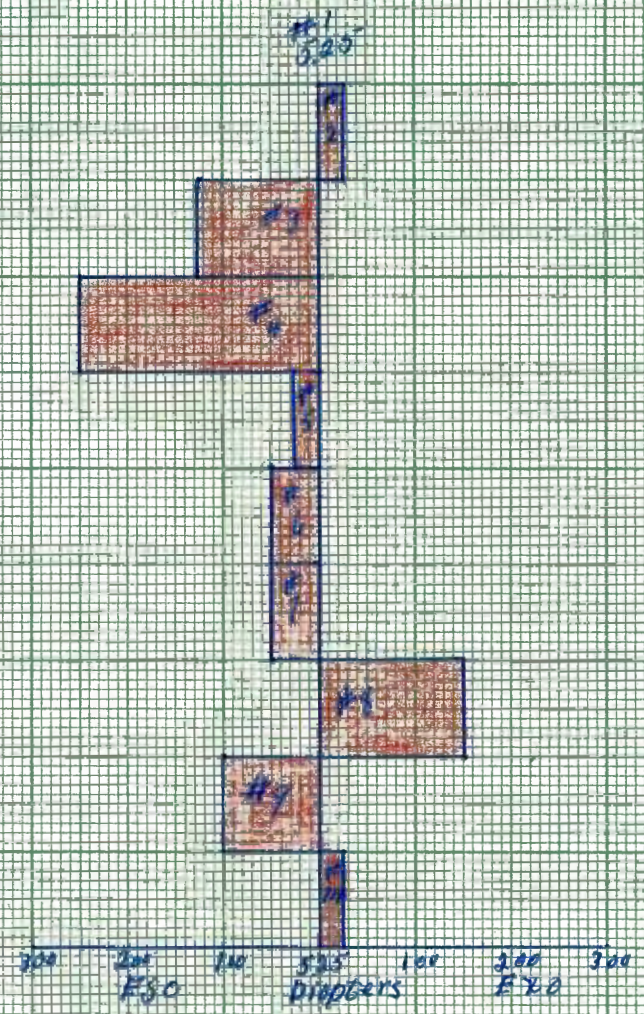
	POSITION									
	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	# 10
mean Ave	5.25 x0	5.50 x0	4.00 x0	2.75 x0	5.00 x0	4.75 x0	4.75 x0	6.75 x0	4.25 x0	5.50 x0

Group Graph #1

Difference from position #1 in diopters

Group Average Sigma = .46

Mean Response for Ten Subjects

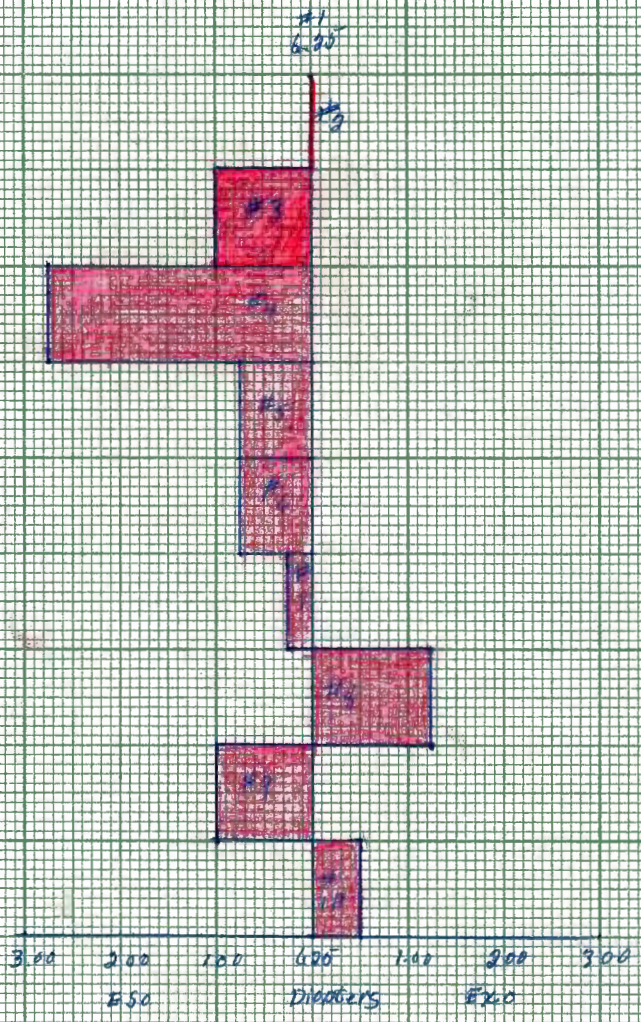


Graph #2

Difference from position #1 in diopters

Group Average σ = .96

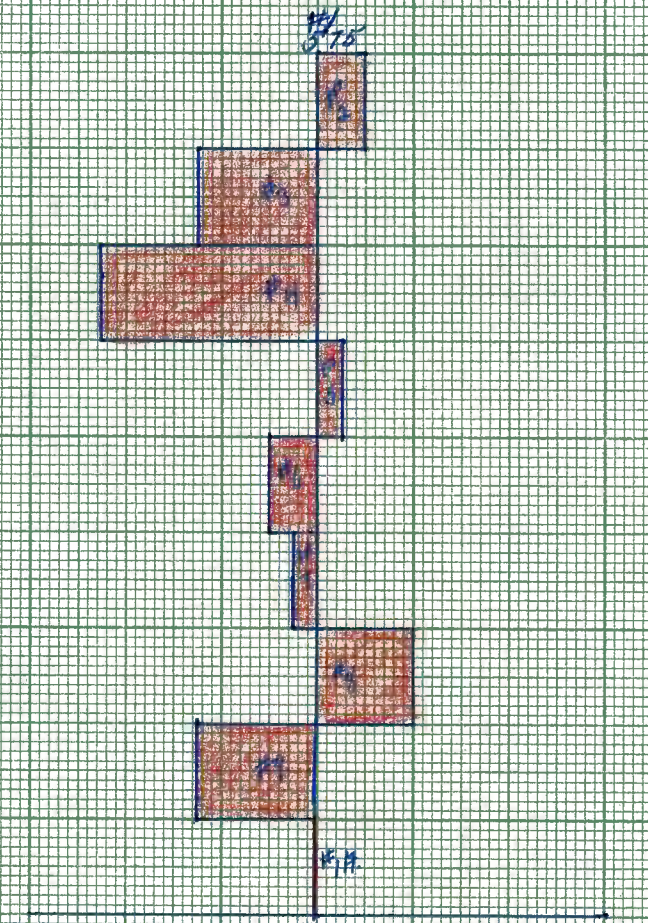
Subject #1 σ = .84



Graph #3

Difference from position #1 in diopters

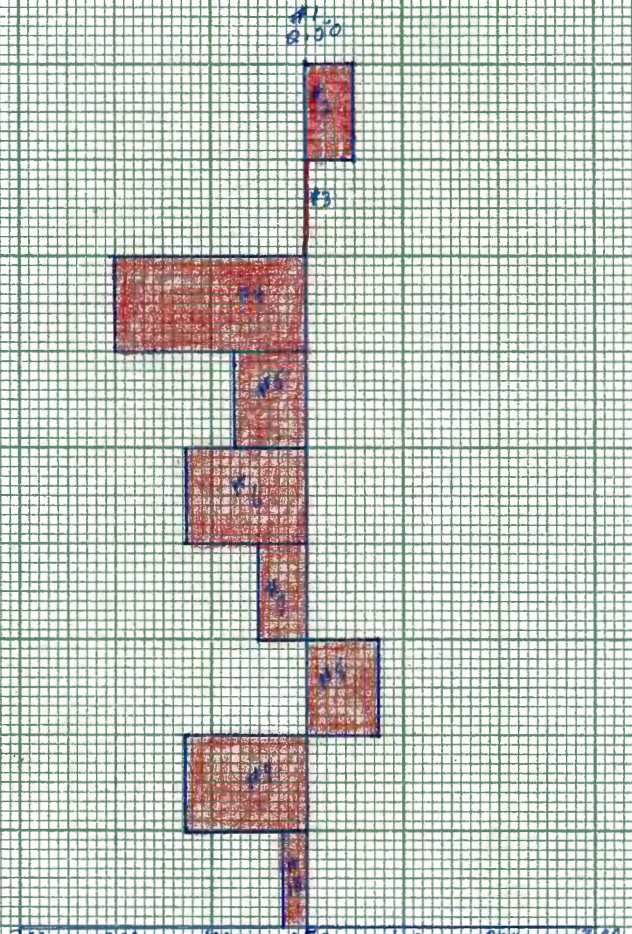
Subject #9 Average σ = .52



Graph #4

Difference from position #1 in diopters

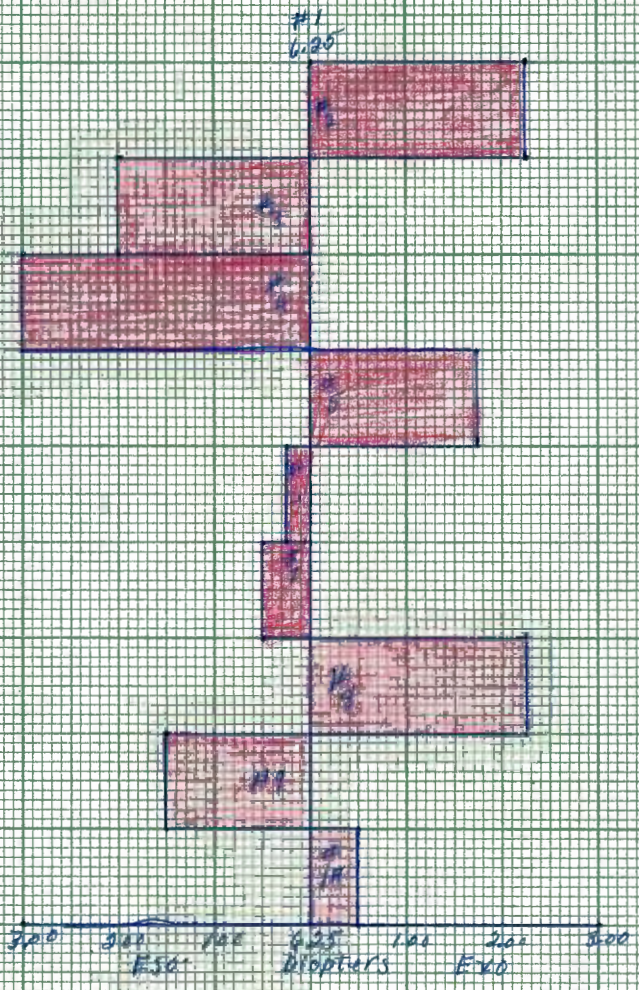
Subject #3 Average $\bar{d} = 1.35^{-}$



Graph #5

Difference from Position #1 in diopters

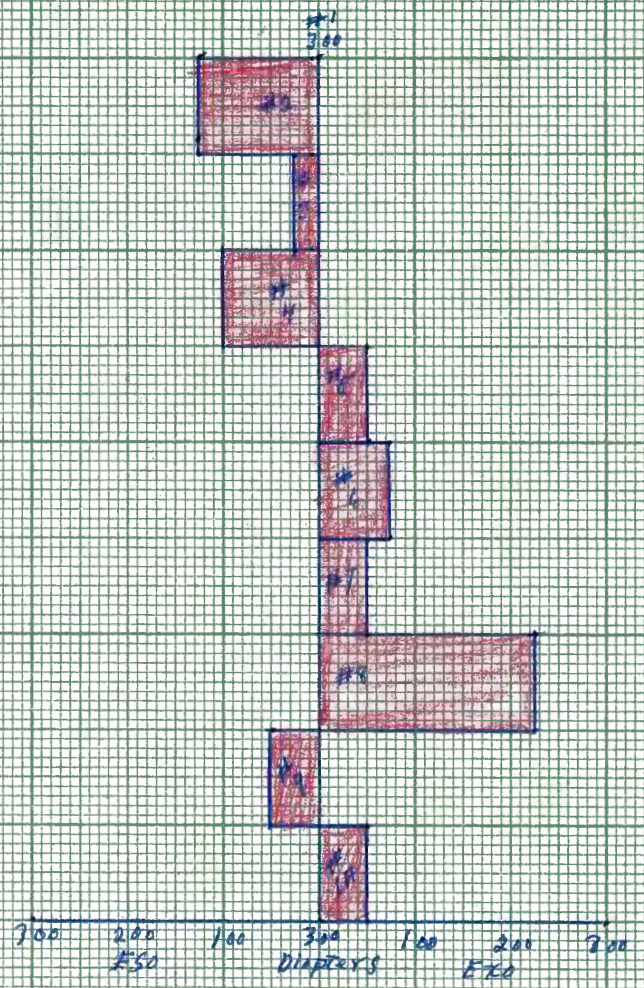
Subject #4 Average σ .51



Graph #6

Difference from position #1 in diopters

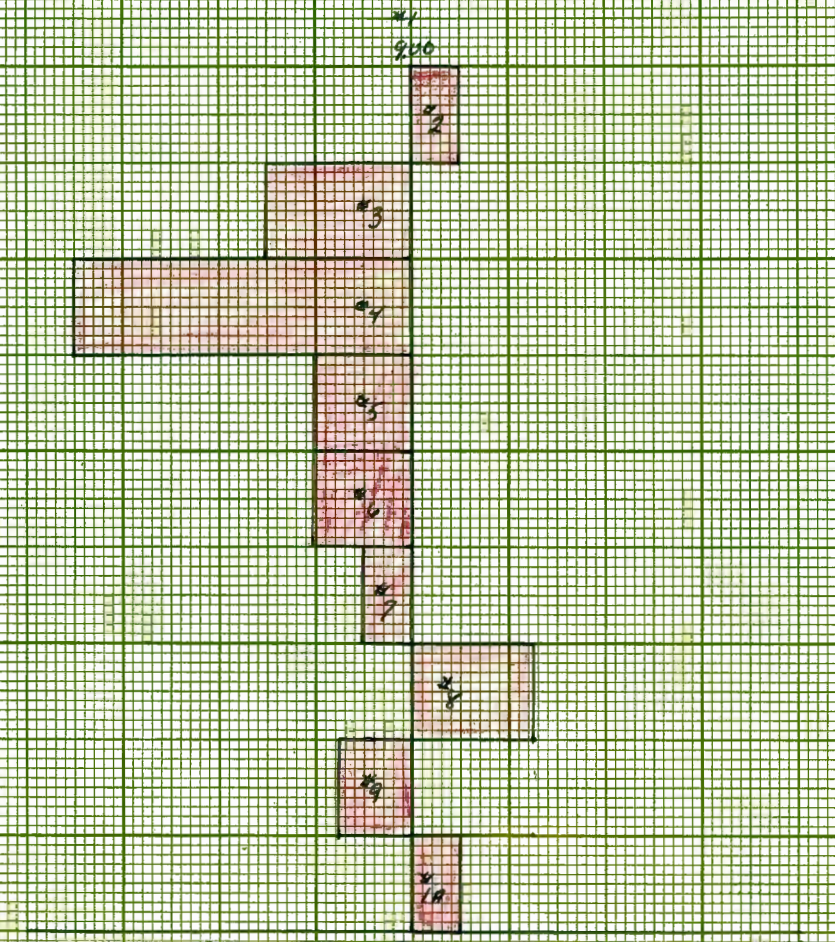
Subject #5 Average of 5 to 2



Graph #7

Difference from position #2 in diopters

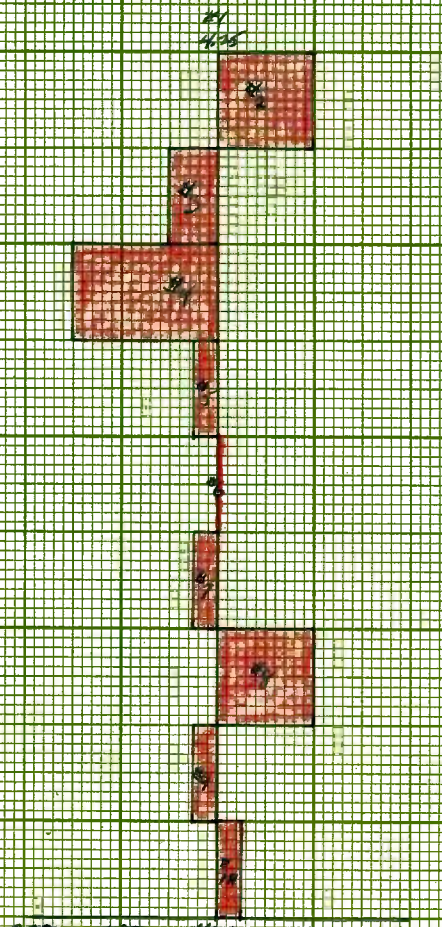
Subject #6 Average σ = 1.08



Graph #8

Difference from position in diopters

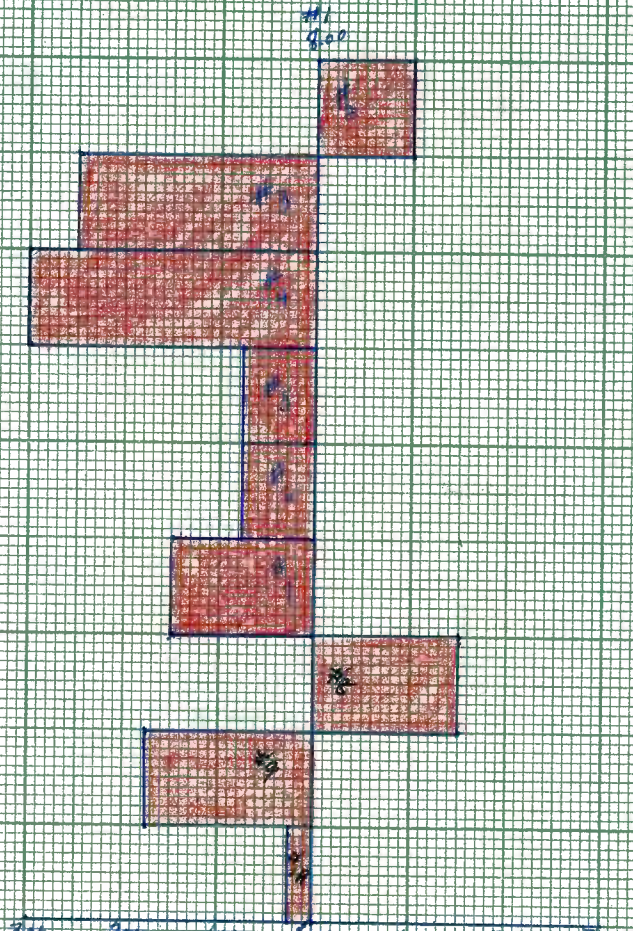
Subject #2 Average E = 1.33



Graph #9

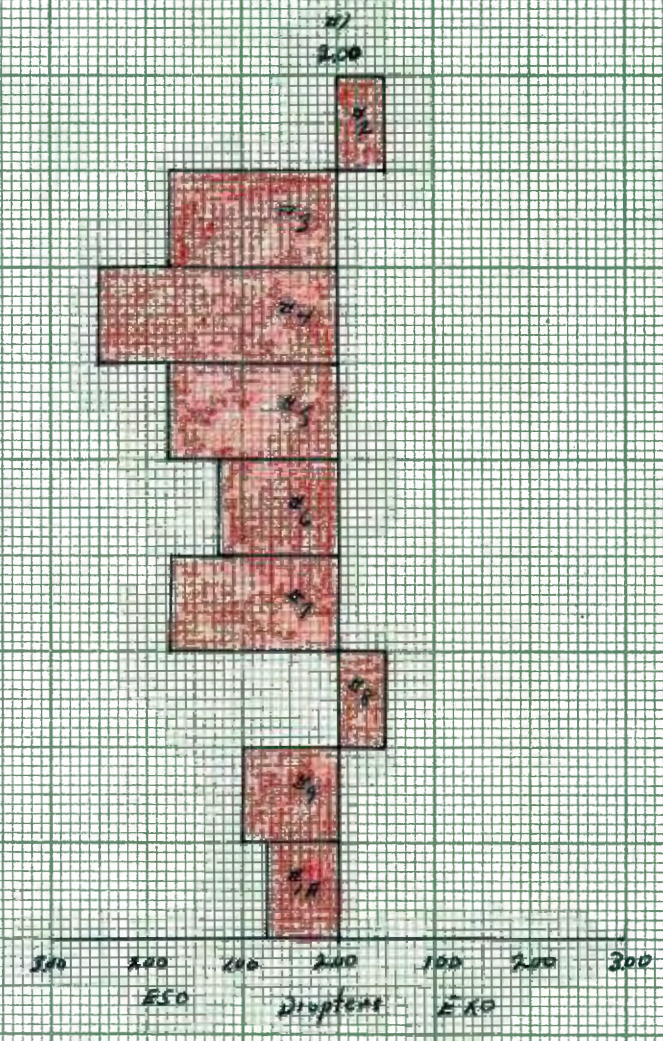
Difference from #1 position in diopters

Subject #8 Hwange 8-12



Graph #10

Subject #9 Average $\pi = 1.21$



Graph #11

Difference from position of in diopters

Subject #10 Average σ = .68